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YIELDS OF GREEN MOUNTAIN AND COBBLER POTATO VARIETIES GROWN ON GOLDEN NEMATODE INFESTED SOIL

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The golden nematode, *Heterodera rostochiensis* Wollenweber, which attacks only potato and tomato plants among commercial crops is not known to occur in the western hemisphere outside of Long Island, New York State. Of the several thousand acres shown to be infested only a few are considered to be heavily-infested.

The golden nematode also occurs in Great Britain (including the Jersey Islands), Ireland, Sweden, Denmark, Holland, Belgium and Germany. Goffart (1933), Leiper (1940), Miles and Miles (1945), Bainbridge (1946), Holmberg (1946), Wood (1946), and Oostenbrink (1950), among others, have reported the serious nature of this disease on potatoes in the European countries. In potato fields where the disease had been observed recently, Smith and Prentice (1929) found a positive correlation between intensity of disease symptoms and cyst content of the soil. The golden nematode is recognized as a major pest of tomatoes in Yorkshire,

England, where high soil populations of this nematode result in unthrifty growth and poor yields (Thompson 1949).

As reported by Cannon (1941), one grower in the Hicksville area on Long Island in 1934 and 1935 noticed a potato field with several spots twenty feet across, where the potatoes grew poorly, died early, and the spots became overgrown with weeds. Cannon first recognized that this trouble was caused by a nematode. B. G. Chitwood of the Division of Nematology of the United States Department of Agriculture identified this nematode as *Heterodera rostochiensis*.

Chitwood, Clement, and Gordon (1942) reported 30-70 per cent crop loss in western Long Island. In 1944 these authors reported that experimental plots with "many" nematodes yielded 43 per cent less than adjacent plots with "few" nematodes.

Haasis and White-Stevens (1944), also working on Long Island, compared yields of Green Mountain and Cobbler varieties on adjacent areas of a field lightly and heavily-infested with the golden nematode. The yields of the Green Mountain variety were 60 per cent less and the yields of the Cobbler variety 27 per cent less on the heavily-infested area.

The golden nematode reduces the size of potato tubers by feeding on the roots. Yields are affected only when, in heavily infested soil, thousands of nematodes attack the roots of one plant. The feeding of this pest does not mar the appearance of potato tubers nor affect their palatability.

In 1948 a field of approximately eight acres of potato land was made available for experimental purposes. This land had been planted with potatoes for a number of years and was unevenly-infested with the golden nematode throughout the field.

Procedure

Early in April, before potatoes were planted, soil samples were taken with a trowel to a depth of four to six inches at fifteen foot intervals over the entire field. Each soil sample was air-dried for several weeks, thoroughly mixed and the total number of cysts per two-ounce sample determined (Map 1). This survey indicated that approximately 1.1 acres were heavily infested with nematode cysts. Soil with 68 cysts per two ounces, including approximately 24* cysts containing living larvae, was considered to be heavily infested. Johnson and Thompson (1945), working in England showed that potato yield losses occurred in soil in which the cyst population was at this point or higher. These findings have been substantiated on Long Island.

* Viability determinations of cysts taken from this field indicated that approximately 35 per cent of the cysts contained living larvae. Empty cysts remain in the soil for a number of years.

Four hundred pounds of calcium cyanamid per acre were plowed into the soil before planting and 2,300 pounds per acre of 5-10-5 non-acid fertilizer were applied in the row at planting time. The entire field was planted in alternate four-row units of the early variety, Cobbler, and the late variety, Green Mountain. The field was periodically cultivated, sprayed with Bordeaux mixture and DDT, and taken care of by the grower according to the best farm practices. The growing season, with well-spaced rains and cool temperatures, was very favorable for the growth of potatoes.

In order that the correlation between number of cysts and tuber yield could be determined two arbitrary lines (A and B) were laid out across the full length of the field and two (C and D) across the width of the field (Map 1). The lines were located so they passed through heavily as well as lightly infested portions of the field. Lines A and B ran parallel to the potato rows whereas C and D lines were perpendicular.

For determining the correlation between nematode population on the roots with tuber yield potato root samples were taken along the predetermined lines in the middle of June. A single plant sample was taken at 15-foot intervals in each of 16 rows adjacent to line A and 16 rows adjacent to line B. A single plant from each of the 212 rows in the field was taken along C and D, the lines running perpendicular to the potato rows.

The samples were taken in June because at that time of the year the female nematodes have emerged from the roots, but are still firmly attached to them. As a result, the females adhere to the roots during the harvesting procedure. In the laboratory the pearly white, spherical females (Figure 1) are easily removed from the roots by a harsh stream of water. To do this, the soil around a plant, including the majority of roots, was taken up by means of a spading fork, gently shaken from the roots and the latter placed in fruit jars containing fifteen per cent formalin solution. The roots of the plants from the four adjacent rows of a like variety were placed in the same jar. In the laboratory a count was made of the females on the roots in each jar by the "washed root technique" (Chitwood and Feldmesser, 1948). The number of females per gram of root was calculated for each four plants. From the entire field 294 samples, representing 1,176 plants were taken.

At digging time yield records were taken of 30-foot sections of each of the 16 rows of potatoes adjacent to lines A and B. Yields were also taken of 30-foot sections from each potato row along lines C and D, 15 feet in each direction from the spot where the root sample was taken. Total yields and yields of U. S. Number 1 size tubers were obtained from 759 30-foot units.

Map Number 1. Numbers of golden nematode cysts in two-ounce soil samples taken 15 feet apart on the square, April, 1948.

A

	116	140	145	186	40	15	22	48	17	0	0	4	4	6	2	14	30	128	9
	83	79	82	197	35	53	10	12	49	6	2	23	1	0	23	27	......	12	....
	230	126	97	235	189	58	59	19	0	1	0	......	0	0	1	0	19	4	4
	66	77	31	76	159	144	136	37	2	4	0	0	1	2	43	24	18	28	4
	96	73	87	103	163	80	74	160	5	31	27	0	2	1	0	21	17	35	0
	126	81	76	84	54	110	111	84	0	6	12	0	3	2	27	2	9	42	2
	128	52	90	81	25	79	44	52	5	2	5	14	......	63	133	19	......	156	2
	89	80	51	55	47	38	103	4	4	11	1	2	13	10	158	73	72	105	1
	60	104	61	80	32	18	9	4	1	3	1	0	0	20	2	93	120	96	3
	75	73	81	69	59	57	20	4	9	0	2	6	0	11	0	5	56	16	91
D	......	77	31	105	3	9	8	13	3	2	0	8	0	135	2	20	70	3	0
	54	63	100	157	6	5	17	44	0	3	0	0	......	12	1	......	......	129	3
	41	194	86	73	6	20	8	7	2	3	2	2	11	53	13	0	40	77	0
	41	65	......	154	14	14	16	20	19	0	3	3	9	75	38	0	8	4	8
	115	178	81	71	6	2	63	34	2	50	6	1	2	7	0	0	0	5	4
	65	119	91	106	23	17	105	15	0	21	1	4	0	0	23	1	1	0	0
	140	42	162	68	25	157	25	14	0	6	1	1	2	12	5	0	8	6	4
	89	108	115	81	4	100	20	3	3	2	1	0	3	7	4	7	64	6	3
	66	127	105	75	18	25	......	32	2	5	1	2	0	2	2	7	6	24	0
	58	117	99	89	10	53	4	35	40	0	3	2	0	1	0	14	35	2	0
	87	260	133	229	68	186	223	37	39	8	0	4	17	3	3	2	15	4	3
	149	98	128	222	90	234	186	194	132	2	1	1	0	0	1	0	14	95	3
	138	194	152	222	......	313	172	47	91	24	2	2	5	0	34	9	4	23	0
	158	162	......	160	65	242	229	194	100	25	0	1	0	0	1	59	9	......	2
	236	156	135	161	129	150	......	157	115	170	6	1	0	6	1	32	3	26	2
	161	127	182	167	73	240	135	102	117	366	151	2	0	2	4	13	21	2	1
	234	192	225	546	......	240	246	210	74	423	255	6	6	0	2	19	11	......	0
C	......	130	100	342	72	294	132	192	82	124	204	29	0	0	1	4	3	22	5
	215	......	143	161	171	256	275	277	77	54	219	......	......	0	0	1	31	2	0
	108	112	139	197	146	......	190	65	14	......	31	54	135	3	2	4	10	33	2
	178	77	......	380	68	169	156	61	43	43	17	26	13	17	31	1	6	7	1
	178	120	157	230	101	209	101	63	16	1	8	7	11	2	7	46	1	0	2
	156	72	115	45	44	63	72	43	7	22	7	3	4	7	14	4	1	3	4
	110	56	119	81	83	60	66	41	0	13	33	1	0	......	28	10	4	6	0
	105	89	85	106	19	41	98	21	1	3	0	2	2	33	0	4	2	8	1
	81	110	94	132	55	18	12	19	0	8	1	0	14	6	0	0	3	23	4
	186	52	56	121	17	6	23	2	23	88	10	3	3	0	4	0	8	7	0
	117	44	66	109	20	15	2	18	7	0	1	13	0	2	11	86	5	12	0
	99	46	56	68	237	90	13	6	1	4	7	1	3	22	30	0	28	17	53
	153	65	104	107	9	15	2	84	4	21	77	38	7	1	0	0	4	7	6

A

Map Number 1. Numbers of golden nematode cysts in two-ounce soil samples taken 15 feet apart on the square, April, 1948.

																		B				
2	0	3	..	0	0	1	4	0	6	2	7	4	0	0	1	5	0	5	0	....	7	
2	..	1	3	0	0	1	3	2	0	0	4	1	5	0	3	5	11	3	3	0	5	
0	2	4	0	0	1	1	0	3	0	3	1	1	1	5	2	1	11	0	0	6	3	
1	..	0	0	0	0	3	......	1	0	3	1	2	1	95	2	3	0	4	......	1	3	
0	3	0	0	..	0	2	5	0	0	2	0	2	0	3	1	....	15	8	40	0	0	
0	0	0	0	1	0	0	43	4	11	12	0	7	11	23	2	0	......	......	20	....	....	
0	0	2	0	3	0	1	45	122	3	9	13	......	130	74	3	0	39	50	24	13	13	
0	0	0	1	1	0	2	......	202	168	39	1	4	48	81	9	19	......	31	13	3	0	
4	1	0	0	0	0	2	12	69	176	58	1	5	6	43	12	57	......	9	5	12	8	
1	3	2	1	0	0	2	11	17	0	9	15	4	11	12	14	10	......	17	11	0	20	
8	2	2	1	6	0	1	4	0	2	0	1	..	21	14	9	5	38	53	57	12	....	D
0	8	0	0	4	4	0	8	10	0	1	4	2	0	2	12	30	76	......	32	56	16	
0	0	0	0	6	0	9	0	1	5	10	1	4	2	1	6	10	138	57	......	....	0	
2	2	0	1	3	0	3	5	2	27	10	3	48	87	24	8	68	22	62	104	38	....	
3	1	1	0	0	0	1	1	0	10	4	3	3	93	59	37	19	76	......	93	22	9	
2	3	0	1	0	1	0	2	1	8	1	0	2	......	15	22	23	49	51	12	66	0	
0	3	6	0	1	0	1	0	0	1	3	0	6	2	1	15	8	......	77	33	12	38	
3	1	3	1	0	0	3	33	1	1	0	0	2	0	0	0	1	59	......	59	10	22	
0	1	1	0	2	3	6	2	0	2	8	1	4	0	0	7	4	8	......	52	10	1	
0	2	0	2	3	..	6	0	0	0	0	3	1	9	0	0	2	14	10	3	11	12	
0	1	0	12	3	1	5	4	......	8	3	......	0	2	2	0	12	......	......	38	6	0	
0	2	..	0	2	3	4	0	1	0	2	0	2	1	2	15	13	45	13	......	22	0	
5	8	1	9	0	3	0	0	0	1	5	0	1	......	....	....	3	......	15	0	....	1	
1	0	0	0	2	6	0	1	0	2	6	12	0	0	0	2	2	10	0	40	0	0	
0	2	1	0	3	5	0	2	0	2	2	1	1	0	0	2	2	1	......	......	4	1	
0	3	0	0	0	1	2	0	0	1	0	0	0	1	0	0	6	......	10	5	8	0	
0	1	0	2	1	3	1	0	......	8	3	1	0	2	1	1	0	......	0	2	....	0	
0	0	..	0	1	1	3	1	0	1	1	0	3	0	1	0	1	......	4	0	1	0	C
0	0	0	8	1	0	0	3	0	1	0	2	0	1	....	0	0	3	......	6	....	0	
3	0	8	1	1	1	5	0	9	2	0	1	2	0	0	....	....	11	......	......	15	0	
0	0	0	2	0	4	0	0	1	4	3	0	3	1	0	....	0	0	0	2	1	0	
3	0	0	0	1	0	0	1	1	2	1	6	3	3	1	1	1	8	12	0	4	0	
0	3	0	1	3	4	0	9	......	12	7	0	0	0	0	10	0	0	0	7	7	0	
0	1	6	0	1	1	0	11	....	5	0	......	1	0	0	3	1	3	5	3	2	0	
0	0	..	3	0	1	0	0	3	0	0	1	7	0	0	6	0	......	0	......	....	0	
0	0	1	0	3	..	0	0	3	0	1	1	1	2	0	....	0	0	0	4	3	0	
..	3	0	0	0	2	3	0	0	0	0	0	4	0	2	2	0	1	2	17	4	0	
0	1	0	0	1	2	0	0	10	0	0	0	8	0	0	2	1	32	......	4	2	0	
0	0	2	0	0	3	0	0	2	0	0	4	......	0	2	0	0	18	0	0	13	....	
..	1	5	0	0	1	0	1	0	0	0	......	2	0	2	42	0	0	0	0	3	0	
																		B				

Figure 1. Immature females of the golden nematode *Heterodera rostochiensis* Wollenweber on potato roots.

Results

The yields in the various 30-hill units were related to the numbers of cysts recorded from soil samples taken in April at points nearest each yield unit (Table 1). It is evident that total and U. S. Number 1 size yields of both the Cobbler and Green Mountain varieties were greater in areas of the field where fewer nematode cysts were present in the soil. When the statistical significance of the yield differences was measured by the use of Student's "t" all differences in yields of the various cyst population groupings were significant by odds greater than 535:1.

TABLE 1.—*Tuber yields and numbers of cysts in the soil.*

No. of Cysts per 2 Oz. of Soil	No. of 30 Hill Units	Green Mountain Yield (Bu./Acre) U. S. No. 1	Green Mountain Yield (Bu./Acre) Total	No. of 30 Hill Units	Cobbler Yield (Bu./Acre) U. S. No. 1	Cobbler Yield (Bu./Acre) Total
0-49	280	325±9*	376±17	188	359±17	407±9
50-99	48	234±26	277±26	80	282±9	316±17
100-up	52	111±17	162±17	60	214±17	248±17

* Standard error of the mean.

Yields in the 30-hill units also were related to the number of immature females on potato roots dug in June from points nearest each unit (Table 2). Plants of the Green Mountain and Cobbler varieties with fewer immature females on their roots yielded more than did plants with roots more heavily infected. The total yield of plants of the Green Mountain variety with an average of 100-199 cysts per gram of root was not statistically significant from that of plants with an average of greater than 200 cysts per gram of root. All other yield figures of the three infection classes differed significantly with odds greater than 287:1.

The yields of Green Mountain were reduced by the presence of the golden nematode more than the Cobbler yields in all comparisons.

TABLE 2.—*Tuber yields and numbers of immature females on potato roots.*

No. of Immature Females per Gram of Root	No. of 30 Hill Units	Green Mountain Yield (Bu./Acre) U. S. No. 1	Green Mountain Yield (Bu./Acre) Total	No. of 30 Hill Units	Cobbler Yield (Bu./Acre) U. S. No. 1	Cobbler Yield (Bu./Acre) Total
0-99	256	342±17*	385±17	264	359±9	393±9
100-199	64	180±60	222±60	80	248±17	274±17
200-up	64	111±17	188±34	28	171±86	197±77

* Standard error of the mean.

Discussion

The number of viable cysts per two ounces of soil is a more reliable index of the degree of infestation of the soil than is the total number of cysts per two ounces. It was not possible to use this criterion because of the time required to make viability determinations. For this experiment it was thought more desirable to include a large number of total cyst counts rather than a smaller number of viable cyst readings. In this recently-infested field it is quite likely that the total number of cysts is proportional to the number of viable cysts per unit weight of soil. This relationship would not exist in a field infested for a longer period of time.

Heavily infested areas distributed uniformly throughout the field would have been more desirable for this experiment. However, yields of 30 hill units dug from soil with very few nematode cysts were uniform throughout the various parts of the field. This indicated that yields in various parts of the field would have been comparable in the absence of the golden nematode infestation.

Summary

In a field of commercially grown potatoes the yields of a late variety, Green Mountain, and of an early variety, Cobbler, were found to be inversely related to the numbers of golden nematode cysts found in the soil. In addition, the tuber yields were inversely related to numbers of immature females present on the roots of both varieties. These relationships existed when either total yields or U. S. Number 1 size yields were used. Green Mountain yields were reduced to a greater extent than were the yields of the Cobbler variety in the presence of high cyst populations in the soil and high immature female counts on the roots.

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CLONAL VARIATIONS IN THE CHIPPEWA POTATO VARIETY

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(Accepted for publication March 5, 1951)

A wide range of plant characters has been observed in the Chippewa potato variety grown in commercial fields and tuber-unit seed plots in Northern Wisconsin during the past decade. Variations in plant characters have been studied in the field and greenhouse. An attempt has been made to determine variants due to (1) environmental effects such as climate, cultural practices and soil conditions (2) disease effects, especially responses to virus diseases under varying conditions of growth and (3) genetic origin.

Materials and Methods

Several hundred advanced generation clonal selections of Chippewa have been grown annually at Starks Farms and the University Potato Seed Farm for a period of about 12 years. Constant selection for desirable vine and tuber types as well as for productivity has been practiced. A considerable wealth of material has been developed in both programs showing obvious variations from the parent seed stock. Retrogressive changes as well as favorable changes have occurred in the variety, and they are apparently quite stable.

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Paper No. 453 from the Department of Genetics, University of Wisconsin.

The following contrasting characters have been observed in clonal lines of the Chippewa variety:

	Normal	*Variant*
1.	Pigmented blossom	White blossom
2.	Green leaves	Yellow-green leaves
3.	Medium leaves	Small leaves
4.	Medium leaves	Thick leathery leaves
5.	Medium vine	Dwarf vine
6.	Medium vine	Prostrate vine
7.	Medium maturity	Early maturity (2 weeks)
8.	Medium maturity	Late maturity (2 weeks)
9.	Smooth tuber skin	Russet tuber skin
10.	Flat oval tubers	Round tubers

Certain selections were observed to yield more than others when grown under uniform conditions in the two seed improvement programs located in Northern Wisconsin. Similar differences in the yielding ability of certain Chippewa strains were also noted in potato variety tests in New Jersey and in table stock production fields in various parts of the country. Investigations now in progress were started in 1948 to deal with both pathological and genetic variation in the variety and insofar as possible to determine their origin. Eleven advanced generation clonal strains which exhibited unusual attributes and five unrelated normal appearing strains were selected for detailed studies during the three-year period of the investigations (Table 1). A brief description of the strains is as follows:

Starks 1 — medium maturity; vigorous vine; medium to high yield.

Starks 20 — late maturity; vigorous upright vine; high yield.

Starks WB — late maturity; vigorous vine; white blossom; high yield.

Starks 14 — late maturity; vigorous vine; high yield.

Starks 46 — late maturity; vigorous vine tends to remain green until killed by frost; blossoms late; high yield.

Starks RC — late maturity; blossoms late; russet tuber skin; high yield.

Starks 9 — early maturity; Irish Cobbler season; prostrate vine fails to enlarge after blossoming; reduced yield.

Starks 2 — late maturity; vigorous vine; high yield.

Starks 5 — early maturity; few days later than Starks 9; prostrate vine fails to enlarge after blossoming; reduced yield.

Strains W, N, E, Ml, M2 and XF (unrelated Chippewa lines) — medium maturity; normal vine; average yield.

The XF strain was produced on the University seed farm. Inoculation tests on *Nicotiana rustica* and *N. tabacum* indicated that this clonal line was free from the latent-mosaic virus. Similar tests demonstrated that all of the other clonal lines carried various mild strains of the latent-mosaic

virus. This phase of the investigation is being carried forward and the results will be reported at a later date.

The yielding ability of the 16 Chippewa strains listed in table 1 was tested in field plots at Starks, Wisconsin during the 1948, 1949 and 1950 seasons. Each strain was grown in six randomized blocks, 30 hills per plot.

Experimental Results

Favorable cultural conditions were maintained in the test plots as indicated by better than average potato yields for the region. Yields ranged from a high of 577 bushels per acre for the Starks 20 strain in 1948 to a low of 392 bushels per acre for the Starks 9 strain in 1950. Ten of the 16 strains were tested over a period of three years. The yield data for these 10 strains show that significant differences in yielding ability occurred each year and that the strains maintained their rank reasonably well during the three year period. The high yielding Starks 20 strain placed first each year while the low yielding Starks 5 strain ranked tenth, ninth and eighth. The balance of the strains varied from one to three places in rank. If the 10 strains under consideration are divided in half it will be noted that the five highest producing strains gave yields of more than 500 bushels per acre in 13 out of 15 trials whereas the five lowest producing strains gave yields of less than 500 bushels per acre in 13 out of 15 trials. The least significant difference figure of 34 bushels per acre obtained for the three year averages of the 10 strains indicates that the two groups of strains differed in their yielding ability.

Both high and low yields were produced by the six strains which have been under test for only one or two years. Strain M2 produced exceptionally light crops during 1948 and 1949. The early-maturing Starks 9 strain exhibited variable results ranging from a high of 523 bushels in 1949 to a low of 392 bushels in 1950. Starks 12, 14 and WB strains produced heavy crops. The University Potato Seed Farm XF strain (latent-mosaic virus-free) produced an average crop during the 1950 season.

Discussion

Clonal selection within commercial potato varieties is widely practiced in the development and maintenance of superior seed stocks. It is now well established that two important objectives can be accomplished by this method, namely, elimination of (1) disease and (2) undesirable plant types of unknown origin.

The relation between degeneration or "running out" troubles of potatoes and the rather large and incompletely known group of virus diseases to which the potato exhibits various degrees of susceptibility is well established. However, evidence has been slowly accumulating which indicates that not

all of the degeneration commonly observed is necessarily of virus origin. Clonal lines of Chippewa derived from single hills or tubers showing lack of vigor and yielding ability have been observed annually in the seed improvement programs at both the University Potato Seed Farm and the Starks Farms. Some of these low yielding lines have been held under observation in isolated plots and in the greenhouse for several seasons. There was no indication that their lack of vigor was associated with disease. A more detailed study was made on certain clonal lines of Chippewa listed in table 1. All of the Starks strains and strain W have been maintained in isolated tuber-unit fields for a period of five or more years. A thorough roguing program was followed. These strains were examined for the presence of diseases at frequent intervals throughout the growing season in Northern Wisconsin. They were also examined for disease content during the winter and spring months in greenhouse test plantings at Madison, Wisconsin and in field test plantings at Fairhope, Alabama. These studies revealed that all of the Starks clonal lines and the W clonal line of Chippewa were symptomless carriers of various mild strains of latent mosaic or X virus. Only occasional trace amounts of other diseases associated with the "running out" troubles of potatoes were noted. The differences in yielding capacity exhibited by these clonal lines may be associated with the interaction between strains of the latent-mosaic virus and the host. A relationship of this kind is suggested in the reports by Schultz (9) in America, Bald (2) in Australia, Smith (10) in England and Clinch (3) in Eire. The first three workers mentioned have presented evidence that yields were reduced in potato varieties infected with latent-mosaic virus when compared with virus-free clones of the same varieties. The fourth worker, Miss Clinch, observed that infection of Up-to-Date potatoes with latent-mosaic virus caused no reduction and even a slight increase in yielding ability as compared with virus-free clones of the same variety. Similar results are recorded in table 1. Six of the 13 clonal strains of Chippewa infected with latent-mosaic virus yielded less and seven yielded more than the latent-mosaic virus-free XF strain. The high yielding Starks clonal lines WB, 14 and 20 produced significantly more and the low yielding Starks clonal line 9 produced significantly less than the virus-free XF strain. These findings suggest that causes other than disease may also contribute to clonal variation in potatoes.

Abrupt and permanent changes in plant characters have been observed from year to year in certain clonal lines. Outstanding examples are changes from normal pigmented blossoms to white blossoms (Starks WB) and changes from normal smooth tuber skin to russet tuber skin (Starks RC). Although discontinuous variations of this kind occurred infrequently they were easily recognized in large populations. There is evidence that differ-

TABLE 1.—*Yields in bushels per acre for 16 Chippewa strains grown at Starks, Wis. during* 1948, 1949 *and* 1950.

STRAINS	BUS. U.S. NO. 1 TUBERS PER ACRE*			
	1948	1949	1950	3-Year Av.
Starks 20	577	550	550	559
" RC	567	519	516	534
" 2	550	519	523	531
" 46	534	546	470	516
" 1	517	543	464	508
Strain M1	489	473	484	482
" E	494	478	460	477
" W	513	464	423	466
" N	501	478	407	462
Starks 5	479	469	425	458
Strain M2	466	445	......	
Starks 9	......	523	392	
" 12	......	503	......	
" 14	......	527	546	
" WB	......	546	552	
Strain XF	......	......	469	
L.S.D.	39	62	72	34

* Yield tests were planted in 6 randomized blocks, 30 hills per plot.

ences of this kind arise as somatic mutations. Darst (1924) made an extensive study of bud mutations in the potato. He collected and examined 21 distinct variations in the variety Eigenheimer. Asseyeva (1) found that most of the bud mutants studied were periclinal chimeras. More recently Krantz (5) reported on the chimerical nature of the Red Warba variety. The origin and value of two smooth-skinned varieties selected from Russet Rural has been reported by Livermore (6). Rieman (7) reported higher resistance to scab for a russet-skinned mutant selected from the smooth-skinned Sebago variety.

Similar variations having to do with yielding ability may also occur, but it is extremely difficult to observe or to isolate them with certainty. The Starks strains and University State Seed Farm strains of Chippewa listed in table 1 are the product of an extensive clonal selection improvement program. The progeny of at least nine thousand tubers was studied annually for a period of 12 years. It was found that differences in yielding ability were readily obscured by environmental influences. Most of the selection effort was directed towards increased yielding power. Clones exhibiting reduced production were discarded. A few early-maturing clones like Starks 5, which appeared to be desirable, were saved even though they did not show high productivity. The statistically significant differences in yield between the Starks 5 strain and the Starks strains 20, RC 2, 46 and

1 recorded in table 1 furnish evidence that mutations affecting yielding ability may have occurred in this variety. On the other hand, there is also the possibility that these differences were brought about entirely or in part by the interaction of various mild strains of the latent-mosaic virus and the host.

In considering these two causal agencies it should be kept in mind that variations in yielding ability caused by disease are generally more readily demonstrated than are such variations due to somatic mutations. A considerable body of information is now at hand dealing with virus diseases. By contrast little is known about the inheritance of quantitative characters such as yielding capacity. Inheritance studies in the potato have dealt for the most part with qualitative characters that can be distinguished accurately. Variations in qualitative characters caused by somatic mutations have been recognized for many years, and their occurrence is seldom questioned. There seems to be no valid reason why mutations affecting quantitative characters should not occur. It appears that more suitable methods and materials will have to be developed in order to establish genetic proof that somatic mutations affecting yielding ability occur or do not occur in the potato. This question is fundamental to our understanding of potato variety maintenance.

The old problem of potato degeneration has received a pathological interpretation during the past 40 years. During this period the spectacular relationship between virus diseases and the "running out" troubles of potatoes has obscured the fact that the nature of the complex has never been completely ascertained. The following statement made by Salaman (8) in 1926 can, in general, be applied at the present time. "To return, however, to the varieties as we know them, it cannot be denied that most, however good in their day, last no more than about twenty five years. To this general rule there are, however, some notable exceptions." Degeneration phenomena variously referred to in seed improvement programs throughout the country as slow, weak, or unproductive types have appeared regularly. Attempts to associate certain reductions in vigor with causal agencies have frequently been unsuccessful. Material of this kind is usually discarded. The extensive clonal selection program carried on with the Triumph variety by Werner (11) in Nebraska and the clonal selection program with the Chippewa variety described in this report tend to show that these unproductive variants are heritable and that their occasional appearance is the rule and not the exception in asexual potato propagation. Therefore, the clonal selection method may not only be a valuable tool for the control of disease but also a valuable tool to maintain varieties at high levels of productivity by eliminating deleterious variants of genetic origin.

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DISEASE AND INSECT CONTROL ON POTATOES IN OHIO IN 1950

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Experiments on disease and insect control on potatoes were conducted at Wooster, Willard, and Marietta in 1950. This arrangement made it possible to compare various materials under different environmental conditions and different degrees of severity of disease and insect attack. One group of 24 different treatments was used on Cobbler potatoes at all three locations. These included an untreated check, five different insecticides (all used with Tribasic), and 12 different fungicides (all used with DDT). Data relative to 18 of these treatments are given in table 1. The others were omitted because they are of little significance in this discussion of disease and insect control.

At Marietta the plants were soon attacked by early blight, and a short time later by late blight. The untreated check plots died comparatively early, and many of the plots being treated with fungicides incapable of checking late blight were defoliated a few days later. Dithane gave the best control of late blight in this experiment, closely followed by Tribasic plus p.e.p.s. (treatment 8). P.e.p.s. is a mild fungicide, and also an adhesive, which has given good results when used with the fixed coppers. Crag 658 and Cop-O-Zink gave fair control of late blight. Dithane D-14 plus DDT was significantly better than 15 of the other treatments used in the experiment at Marietta. Tribasic plus p.e.p.s. was better than 12 others, as was Dithane Z-78. Cop-O-Zink was significantly better than at least four other treatments. The remainder of the fungicidal formulations used were significantly better than the check only.

Dilan gave the best yield of the insecticides used, but was not significantly better than any of the others. EPN ranked second, followed by parathion, aldrin, and DDT in that order.

At Wooster no late blight appeared and early blight was of only medium severity. Many of the plants died early from an excess of soil moisture, and attacks by bacterial wilt and black leg. Consequently, the data of this experiment are of comparatively little significance. Most of the treatments gave yields which were significantly better than the untreated check but there was comparatively little difference among the different treatments.

The experiment located on muck soil at Willard differed from those at Marietta and Wooster in that late blight was scarce and early blight was

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very severe. Thus, the materials were sorted according to their ability to control that disease, whereas they were classified principally against late blight at Marietta. Dithane D-14 and Methasan slurry (treatment 14) gave the best results from the standpoint of foliage condition. Dithane Z-78 also did very well. On the basis of yields, only five treatments were significantly better than the other nineteen. These were Dithane D-14, Dithane Z-78, Methasan S, Methasan B (not listed), and Tribasic plus parathion. The performance of parathion was outstanding among the insecticides used in this experiment where leafhoppers were numerous and some aphids were present. Dilan also did well; and it may be noted that it slightly outyielded parathion and had a somewhat better foliage score in an average of all three of the experiments listed in table 1.

The best average yield for the three experiments resulted from the use of Dithane Z-78 and this was closely followed by Dithane D-14 plus $ZnSO_4$. Tribasic plus p.e.p.s. was third, with Methasan S and COC-S tied for fourth. Several other treatments were approximately equal in succeeding positions. The addition of p.e.p.s. to Tribasic increased the yield average for the three experiments by nearly 30 bushels per acre. This adhesive has consistently improved the performance of various fixed coppers but has been less effective when added to such organic fungicides as Zerlate and Dithane.

Dithane D-14 plus $ZnSO_4$ gave the best average foliage score, but it was followed closely in this respect by Methasan S and Dithane Z-78. Methasan S, which was formulated by the manufacturer as a slurry, gave better control of both early and late blights on the foliage than did the same chemical (Zerlate) in a dry formulation. Cop-O-Zink gave somewhat better results than Tribasic; Crag 658, which also contains both copper and zinc was similar to Cop-O-Zinc in both yield and foliage score. Robertson fungicide, a finely divided copper in the metallic form, and a new organic copper indicated here as copper cupferron, gave results similar to the other copper-containing fungicides used in these experiments.

Among the insecticides Dilan gave the best average yield, followed by parathion. The best average foliage condition, however, was furnished by parathion, with Dilan doing nearly as well. At Willard where insects were numerous the plots treated with parathion were outstandingly better than those treated with any other insecticide.

Many of the materials used in the 3-location experiment just discussed were used on later planted Katahdins at Wooster. Some of the data relative to this experiment are given in table 2. Early blight appeared rather early in the development of these potatoes, and about September 1 late blight was present. Both diseases became relatively severe before frost injured the vines slightly in late September.

TABLE 1.—*Potato yields and foliage scores at Marietta, Wooster, and Willard when sprayed with the same fungicides at all three locations. Only early blight present at Wooster and Willard, both early and late blights at Marietta.*

Treatment Number & Materials	Formulas	Yield in Bus./Acre				Per cent Foliage Dead			
		Marietta	Wooster	Willard	Averages	Marietta 7/7	Wooster 8/4	Willard 8/30	Averages
1. No treatment		332	300	600	411	55	91	90	79
2. Tribasic plus DDT	4-1-100	390	346	652	463	22	56	62	47
3. " plus parathion	4-1-100	410	348	678	479	20	63	47	40
4. " plus aldrin	4-1-100	392	345	629	455	24	47	57	43
5. " plus Dilan	4-1-100	437	355	665	486	17	50	55	41
6. " plus EPN	4-1-100	416	334	643	464	17	51	62	43
7. " plus DDT	3-1-100	387	335	628	450	22	50	62	45
8. " plus p.c.p.s. plus DDT	4-½-1-100	455	350	671	492	15	51	50	39
9. Cop-O-Zink plus DDT	4-1-100	431	351	646	476	20	42	47	36
10. COC-S plus DDT	4-1-100	412	369	642	488	20	56	52	43
11. Robertson fungicide plus DDT	2.2-1-100	383	359	669	470	28	51	52	44
12. Copper cupferron plus DDT	3-1-100	393	386	674	484	31	45	45	40
13. Crag 658 plus DDT	2-1-100	413	374	649	479	30	46	47	41
14. Methasan S plus DDT	3-1-100	382	380	701	488	22	38	27	29
15. Zerlate plus DDT	2-1-100	395	381	674	483	28	37	55	40
16. Zac X6 plus DDT	6-1-100	368	365	644	459	38	45	52	45
17. Dithane D-14 plus $ZnSO_4$ plus DDT	4-1-1-100	464	382	688	511	9	37	25	24
18. Dithane Z-78 plus DDT	2-1-100	455	376	708	513	12	44	32	29
L.S.D. at 5 per cent		48	51	47					

The foliage condition remained good until September 15 on the plots treated with Dithane D-14, Parzate dry, and MnEBD (an ethylene bis compound similar to Parzate except that the zinc of Parzate is replaced by manganese). Most of the plots that received a fixed copper also remained green for a considerable time longer than the check plots, as did those treated with Bordeaux. Methasan slurry (treatment 11 in table 2) again gave good control of early blight and was fairly effective against late blight.

Dithane D-14 gave the best yield, closely followed by Cop-O-Zink, Methasan S, Parzate dry, and MnEBD. COC-S plus p.e.p.s. was also very good and somewhat better than COC-S without this adhesive. Bordeaux mixture and Crag 658 (copper zinc chromate) were each significantly better than about half of the treatments (40 of them) used in the whole experiment. The yield of the Bordeaux-treated plots was somewhat disappointing, perhaps because it gave only mediocre control of the heavy attack of early blight which occurred. Parathion gave a somewhat better yield than did DDT or Dilan (all three were used with COC-S in this experiment).

TABLE 2.—*Yield and foliage condition of Katahdin potatoes when sprayed with various fungicides and formulations of the same. Both early and late blight present.*

Treatment Number and Materials	Formulas	Yield in Bu/Acre	Per cent Foliage Dead on 9/10
1. No treatment		428	80
2. COC-S plus DDT	4-1-100	520	36
3. " plus parathion	4-1-100	546	25
4. " plus Dilan	4-1-100	530	26
5. " plus p.e.p.s. plus DDT	4-½-1-100	541	25
6. Tribasic plus DDT	4-1-100	523	25
7. Cop-O-Zink plus DDT	4-1-100	569	26
8. Robertson copper plus DDT	2.2-1-100	528	29
9. Crag 658 plus DDT	2-1-100	522	26
10. Vancide 51 plus DDT	3-1-100	463	32
11. Methasan S plus DDT	3-1-100	557	26
12. Zac S plus DDT	3-1-100	531	34
13. Zerlate plus DDT	2-1-100	493	35
14. Dithane plus $ZnSO_4$ plus DDT	4-1-1-100	584	15
15. Parzate dry plus DDT	2-1-100	557	15
16. MnEBD plus DDT	1.7-1-100	569	15
17. Orthocide 406 plus DDT	2-1-100	488	31
18. Zerlate plus Tribasic plus DDT	1-2-1-100	466	39
19. Bordeaux plus DDT	8-6-1-100	473	29
L.S.D. at 5 per cent		32	

Potatoes (late-planted Cobblers) were sprayed with various fungicides and insecticides used at the "4X" concentration (only one-fourth the usual amount of water). The data relative to this experiment are given in table 3. Late blight became severe about the middle of the growth period. All treatments gave a significant increase in yield over the untreated check. When four different insecticides were used with Dithane, Compound 4049 gave the best yield, followed by Dilan, parathion, and DDT in descending order. When seven fungicides were applied with DDT, Parzate ranked first in yield, followed by COC-S, Robertson fungicide, Methasan S, Vancide 51, Dithane and Zac S. A copper aerosol applied at only 6½ gallons per acre (which contained only one-half the amount of copper normally applied) gave good foliage control of late blight and a yield of 470 bushels per acre.

The data obtained in three different "concentrate" experiments indicate that most fungicides will give good control of both the early and late blights of potato when applied at 40 gallons per acre. If this continues to be true with further experimentation, then it is likely that the so-called "concentrate" sprays someday may be used to control the fungous diseases of row crops.

TABLE 3.—*Yield and foliage condition of late-planted Cobbler potatoes at Wooster when they were sprayed with various fungicides all applied at 80 pounds and 40 gallons per acre. Late blight severe, early blight medium.*

Material and Treatment Number	Formulas	Yield in Bu/Acre	Per cent foliage Dead on 9/10
1 No treatment		337	97
2 Copper aerosol		470	26
3 Dithane Z-78 plus DDT*	8-8-100	429	37
4 " plus parathion	8-4-100	430	44
5 " plus Dilan	8-4-100	455	37
6 Dithane Z-78 plus C 4049	8-4-100	483	40
7 Parzate plus $ZnSO_4$ plus DDT	8-4-8-100	524	19
8 Methasan S plus DDT	12-8-100	453	50
9 Zac S plus DDT	12-8-100	429	67
10 Robertson copper plus DDT	8.8-8-100	457	32
11 Vancide 51 plus DDT	12-8-100	433	62
12 COC-S plus DDT	16-8-100	507	17
L.S.D. at 5 per cent		47	

*DDT as 25 per cent emulsifiable solution.

Fourteen different insecticides were compared in a series of experiments conducted at Wooster on Irish Cobbler potatoes and the data are presented in table 4. DDT, parathion, Methoxychlor, Dilan, and Q137 gave good control of flea beetles and leafhoppers. Aldrin gave good control of flea beetles but it was relatively ineffective against leafhoppers, and for

this reason aldrin is not likely to have a place in the potato spray program. Parathion, lindane, Pestox, and Compound 4049 gave excellent control of aphids but only parathion can be recommended for use on potatoes at this time to control aphids.

TABLE 4.—*Insect control and yields obtained with various insecticides applied to Irish Cobbler potatoes in combination with Parzate* (2-100), *Wooster, Ohio.* 1950.

Treatment No. and Material	Formulas	Flea Beetle Holes per Leaflet	Hopper-burn	Aphid Popu-lations	Yield per Acre
	Lbs. Gals.	No.	Class[1]	Class[2]	Bus.
1 DDT, purified, 50 per cent	1-100	5.9	O	H	675
2 Methoxychlor, 50 per cent	2-100	4.4	O	H	638
3 Parathion, 15 per cent	1-100	7.9	O	O	733
4 EPN, 25 per cent	0.6-100	8.8	L	H	645
5 Chlordane	2-100	6.9	M	M	561
6 Lindane, 25 per cent	1-100	7.0	M	O	537
7 Dilan, 25 per cent	1-100	8.2	O	H	688
8 CS 728, 25 per cent	1-100	8.5	M	H	597
9 Q137, 50 per cent	1-100	7.7	O	H	641
10 BPR	4-100	11.9	M	M	489
11 Pestox	2-100	13.5	L	O	578
12 Aldrin, 25 per cent	1-100	6.8	M	M	443
13 Compound 4049, 50 per cent	2-100	12.2	L	O	649
14 Rotenone, 4 per cent	5-100	9.8	M	M	564
15 Check		15.5	H	M	402

[1]Hopperburn classes: O—None; L—light; M—medium; H—heavy.
[2]Population classes: O—No infestation; L—light infestation; M—medium infestation; H—heavy infestation.

CONCLUSIONS

The zinc ethylene bis dithiocarbamate formulations (Dithane and Parzate) under the conditions of these experiments gave better control of early and late blights, and higher yields, than were obtained with most of the copper-containing fungicides. The zinc dimethyl dithiocarbamate formulations (Zerlate, Methasan, and Zac) gave fair control of early blight but were comparatively ineffective against late blight.

In the presence of late blight the copper-containing materials gave better results than the zinc dimethyl dithiocarbamates, even though they did fall a little short of the results given by Dithane and Parzate.

A variety of fungicides and insecticides applied to potatoes in the "4X" concentration at the rate of 40 gallons per acre and at only 80 pounds pressure gave surprisingly good control of diseases and insects. This suggests that sprays more concentrated than those commonly used may come to be used on row crops when some of the obvious mechanical difficulties have been overcome.

One pound of actual DDT per acre applied at each application gave good control of flea beetles, leafhoppers, and Colorado potato beetles.

Parathion gave excellent control of both aphids and whiteflies.

In these 1950 experiments, DDT used at the rate of one pound of actual DDT per acre at each application, and applied under a rigid schedule in which the first application was made when the plants were not more than 3 or 4 inches high and repeated at 10-day intervals until the vines were dead, gave equally as good control of flea beetles as that obtained in previous years.

SOME OBSERVATIONS ON EFFECTS OF WETTABLE DDT AND EMULSIFIABLE DDT ON POTATO QUALITY AND BLIGHT CONTROL*

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Following the discovery in 1945 to the effect that benzene hexachloride would give excellent control of eastern field wireworms infesting potato soils, a few New Jersey potato growers applied varying amounts of this chemical to their potato soils. In nearly all instances excellent insect control was obtained but some consumer complaints indicated that peculiar off-flavors were present in tubers grown on BHC-treated soils. Samples of tubers from several field experiments designed for wireworm control being conducted cooperatively by members of the Departments of Entomology and Plant Pathology, were submitted to the Food Technology Department** for quality evaluation. During the course of these quality or taste evaluations it became apparent that several tasters were consistently scoring potatoes from untreated controls as possessing off-flavors. Because of this confusion samples of tubers from our potato spray and dust experiments were submitted for quality evaluation in 1949. We were greatly surprised to find that 46 per cent of the tasters scored samples of tubers from plots sprayed with a DDT emulsion as having an off-flavor.

Because of this unfavorable report, a spraying experiment was conducted with the Katahdin variety in 1950 at Deans, New Jersey. To determine the effect of DDT solvents on tuber flavor five plots were sprayed with DDT emulsions, each of which was made from a different solvent. An additional

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** Members of the Food Technology Department prepared, cooked and aided in the judging of potato samples used in this study.

plot was sprayed with a wettable DDT powder; whereas other plots were sprayed with calcium arsenate + basic copper and wettable DDT + basic copper.

When planning the experiment, the problem arose of how to test the various DDT solvents most effectively and it was decided that in order to have the fewest unknown factors it would be best to have all the sprays prepared by one company rather than to use materials prepared by various manufacturers. The Department of Entomology of the Geigy Company agreed to make the DDT emulsions in their pilot plant using the same DDT and emulsifying agent in each sample. The only variable, therefore, was the solvent in the compound. The solvents chosen were five of those most widely used commercially by the manufacturers of DDT emulsions. Nine sprays were applied with a power sprayer at the rate of 125 gallons per acre at 400 pounds pressure starting on June 8 and ending September 6.

The sprays were applied on the following dates: June 8, 21, 28, July 18, 26, August 8, 18, 24, and September 6. All emulsions contained 25 per cent DDT and were applied at the concentration of one quart to 100 gallons of water, whereas the wettable DDT powder contained 50 per cent DDT and was used at the rate of 2 pounds to each 100 gallons of water. No fungicides were used with the DDT emulsions or DDT wettable powder until July 18 at which time late blight became severe in the plots sprayed with the DDT emulsions. At this time those plots receiving only the DDT emulsions were sprayed with a basic copper at the rate of 4 pounds per 100 gallons. A week later they were hand-dusted with a 7 per cent basic copper dust at the rate of approximately 50 pounds per acre, all subsequent spray applications contained basic copper at the rate of 4 pounds per 100 gallons of spray. Despite these applications of copper the blight progressed rapidly, because of the prevalence of heavy dews and relatively cool days, until August 18, when the plants were approximately 75 per cent dead.

Samples of tubers from all spray plots were obtained on September 18 when they were harvested. These samples were stored in a barn on the farm until October 15 at which time they were removed to an underground storage at the College Farm. Tubers were selected from each plot receiving the DDT emulsions and the DDT wettable powder as well as from the plots receiving DDT wettable powder + a basic copper and those receiving 4 pounds of calcium arsenate plus a basic copper. These tubers were submitted to the Food Technology Department where four medium-sized ones were washed and placed in 2-quart pressure sauce pans and allowed to cook for 15 minutes at 15 pounds pressure. The tubers were then removed from the pans, pared and placed on numbered plates from which the tasting panel removed portions for taste. No salt or other ingredients

were added to the tubers. The tasters recorded their reaction on a prepared sheet of paper noting whether or not the sample was pleasing, flat or off-flavor. To our astonishment 90 per cent of the tasters scored one sample as being off-flavor, a second sample was considered to be off-flavor by 50 per cent, and a third sample was classified as off-flavored by 40 per cent, whereas the other tubers were considered pleasing by 80 or 90 per cent of the tasters.

The two samples reported by most tasters to have off-flavors, which were defined either as bitter or posessing a kerosene-like flavor, were from plots sprayed with the DDT emulsions containing the solvents under test. Potatoes sprayed with DDT wettable powder and solvent No. 2 were considered off-flavored by 20 per cent of the tasters, whereas one person reported that tubers from plots sprayed with DDT plus basic copper, or calcium arsenate, plus basic copper, were flat.

This discovery of off-flavor in one sample by 9 out of 10 tasters is considered significant and an indication that some solvents used by manufacturers of DDT emulsions might, under certain conditions, cause off-flavors in potatoes sprayed with these materials. This report is considered exploratory in nature and is not in any way a condemnation of the solvents currently being used in the manufacture of DDT emulsions. It is presented at this time in the hope that others may compare the effects of different solvents on the quality of tubers.

Blight Control

It seems of considerable interest that at the time, blight was observed on approximately 75 per cent of the leaves of plants sprayed with the DDT emulsions, adjacent plants sprayed with wettable DDT powder showed less than 5 per cent of the leaves affected with late blight. Adjacent plots sprayed with four pounds of basic copper + wettable DDT throughout the season had less than 1 per cent blight. We have been unable to determine the cause of this difference in blight control.

There was no apparent difference in the degree of blight infection among the plots sprayed with the DDT emulsions and insect control was also practically the same.

NEW VARIETIES RELEASED — PUNGO

The Bureau of Plant Industry, Soils, and Agricultural Engineering and the Virginia Truck Experiment Station announce the release of a new potato variety named PUNGO, developed and tested jointly by the two agencies.

Pungo was tested under the pedigree number B 76-43, a selection from the cross 96-44 x 528-170. The female parent is an early blight-resistant seedling. The pollen parent is resistant to scab. The cross was made and the seedlings were grown in the greenhouse of the Plant Industry Station, Beltsville, Md. in 1940. Tubers were sent to Maine for increase. B 76-43 was selected in the fall of 1941 and has been tested for yield and other characters in a number of states. It was immune to the common physiological races of late blight in tests in Maine, but showed no appreciable resistance to scab.

The tuber shape of Pungo might be described as elliptical to round-elliptical — somewhat like those of Sebago. They are usually rougher than Sebago but compare favorably in Maine with Green Mountain; they are not so rough as the tubers of Irish Cobbler.

In Maine the Pungo usually matures later than Irish Cobbler but at Norfolk, Virginia, in 1949, they were both mature enough to harvest on the same date — 106 days from time of planting. Kennebec required 124 days to mature.

Pungo has produced high yields in several tests in comparison with standard varieties but was especially productive in Virginia in 1949, out-yielding the Irish Cobbler at Norfolk, Virginia, by over 25 per cent, and at Onley, Virginia, grown with 10 inches of rainfall, by over 75 per cent. Its high yield and blight resistance may make it suitable for the fall or spring crop in Virginia.

It has good cooking quality. In tests at six locations in Maine it averaged about the same in specific gravity as Green Mountain, showing a satisfactory dry-matter content.

Seed for testing was distributed to cooperating state experiment stations by the United States Department of Agriculture and steps have been taken by the Virginia Truck Experiment Station to have the available seed increased so that it can be released to growers. Inquiries concerning seed should be made to the Virginia Truck Experiment Station, Norfolk, Virginia.

Robert M. Salter, *Chief of Bureau*, and Victor A. Tiedjens, *Director*, Virginia Truck Experiment Station

NEW VARIETIES RELEASED — CHEROKEE

The Bureau of Plant Industry, Soils, and Agricultural Engineering, the Iowa Agricultural Experiment Station, and the Indiana Agricultural Experiment Station hereby release a new potato variety named CHEROKEE.

Cherokee was tested under the pedigree number B 61-3, a selection from the cross ((X96-56) x (X528-170). The female parent (X96-56) is an early maturing selection having a high degree of resistance to late blight, and the pollen parent is a late maturing scab-resistant selection. The seedling progeny from this cross was grown in the greenhouse of the Plant Industry Station, Beltsville, Md., in 1940. Tubers from the greenhouse seedlings were planted in Maine, and the first hill of B 61-3 was selected from this progeny in the fall of 1941. It was given preliminary tests and distributed to a number of States for trial. In the tests in Maine B 61-3 was found to be resistant to the common physiological races of late blight and highly resistant to scab. Tests in Iowa, Indiana, and other States have confirmed the earlier observations and demonstrated the resistance of this selection to late blight and scab.

The tubers of Cherokee have an attractive white skin. The shape is generally irregular but predominantly short elliptical, somewhat flattened, frequently having a distinct flattened area on one side toward the stem end. Notwithstanding the fact that it has shown a tendency to produce irregular shapes and second growth in a few locations, the tubers of Cherokee when grown in muck soil in Iowa and Indiana have not been as rough as those of Cobbler. Because of a smoother skin and the absence of scab, it is much more attractive than Cobbler.

In maturity, Cherokee is mid-season, normally maturing about 10 days later than Cobbler.

Cherokee has produced high yields and a high percentage of U. S. #1 potatoes in trials on muck soil. In Iowa during a 3-year period, Cherokee produced an average of 566 bushels per acre of No. 1 potatoes, compared with 461 bushels for Cobbler, 462 bushels for Sebago, and 591 bushels for Kennebec. In Indiana, the average yield of Cherokee in four locations on muck soil in 1950 was 30 per cent higher than that for Cobbler, only 5 per cent below that for Kennebec and Katahdin, and about the same as that for Chippewa.

The cooking quality of Cherokee is good. It has been higher in specific gravity than Cobbler in each of 3 years' tests in Iowa. The difference in favor of Cherokee has averaged about 0.006, or the equivalent of approximately 1 per cent in starch content.

Seed for testing was distributed to cooperating State agricultural experiment stations by the United States Department of Agriculture, and seed is being increased by growers in Minnesota and North Dakota.

George F. Stewart, *Associate Director*
Iowa Agricultural Experiment Station

R. M. Salter, *Chief of Bureau*

N. J. Volk, *Associate Director*
Indiana Agricultural Experiment Station

ANNUAL MEETING

of the

POTATO ASSOCIATION OF AMERICA

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